RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1091，Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied.

Limits

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

Friis transmission formula: **$Pd = (Pout*G)/(4*pi*r^2)$**

Where

Pd = power density in mW/cm^2, **Pout** = output power to antenna in mW;

G = gain of antenna in linear scale, **Pi** = 3.1416;

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm^2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

Test Result of RF Exposure Evaluation
R=20cm
mW=10^(dBm/10)
Bluetooth: antenna gain Numeric=10^(dBi/10)= 10^(-0.68/10)= 0.86
FM: antenna gain Numeric=10^(dBi/10)= 10^(1.2/10)= 1.32

Bluetooth DSS:
Antenna gain: -0.68dBi

Modulation	Frequency MHz	Output power to antenna (dBm)	Target power W/tolerance (dBm)	Max Output power to antenna (dBm)	Max Output power to antenna (mW)	Antenna Gain Numeric (mw)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
GFSK	2402	3.45	3±1.0	4	2.512	0.86	0.0004	1.0	PASS
	2441	2.60	2±1.0	3	1.995	0.86	0.0003	1.0	PASS
	2480	1.49	1±1.0	2	1.585	0.86	0.0003	1.0	PASS
Π/4-DQPSK	2402	5.39	5±1.0	6	3.981	0.86	0.0007	1.0	PASS
	2441	4.66	4±1.0	5	3.162	0.86	0.0005	1.0	PASS
	2480	3.07	3±1.0	4	2.512	0.86	0.0004	1.0	PASS
8DPSK	2402	5.88	5±1.0	6	3.981	0.86	0.0007	1.0	PASS
	2441	5.09	5±1.0	6	3.981	0.86	0.0007	1.0	PASS
	2480	3.73	3±1.0	4	2.512	0.86	0.0004	1.0	PASS

FM:

Operation Frequency: 88.1-107.9MHz,
conducted power comes from the following calculations:

9.5 Equations to calculate EIRP

Calculate the EIRP from the radiated field strength in the far field using Equation (22):

$$\mathrm{EIRP} = E_{\mathrm{Meas}} + 20\log\left(d_{\mathrm{Meas}}\right) - 104.7 \qquad (22)$$

where

EIRP is the equivalent isotropically radiated power, in dBm
E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m
d_{Meas} is the measurement distance, in m

NOTE—Because this equation yields the identical result whether the field strength is extrapolated using the default 20 dB/decade of distance extrapolation factor, or the field strength is not extrapolated for distance, this equation can generally be applied directly (with no further correction) to determine EIRP. In some cases, a different distance correction factor may be required; see 9.1.

FM:

Antenna gain: 1.2dBi

Frequency MHz	Output power to antenna (dBm)	Target power W/tolerance (dBm）	Max Output power to antenna (dBm)	Max Output power to antenna (mW)	Antenna Gain Numeric (mw)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
88.1	-42.02	(-42)±1	-41	0.00008	1.32	0.000000021	0.2	PASS
98.1	-34.83	(-34)±1	-33	0.0005	1.32	0.000000131	0.2	PASS
107.9	-37.84	(-37)±1	-36	0.00025	1.32	0.000000066	0.2	PASS

Remark:
In the case of simultaneous launches for FM and BT:
The Max Calc. Thresholds: FM: 0.000000655, BT: 0.0007

BT and FM: 00.000000655+0.0007 =0.0007 ≤ 1

For the max result: 0.0007≤ 1.0 1g SAR test exclusion threshold, So a SAR test is not required.